

Missouri Department of Health and Senior Services

Hazardous Substances Emergency Events Surveillance (HSEES) Program



1999-2001 Data Analysis

November 2002

EXECUTIVE SUMMARY

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the public health consequences associated with the release of hazardous substances. Since 1993, the Missouri Department of Health and Senior Services (DHSS) has participated in this surveillance system. This report summarizes the characteristics of events reported to the surveillance system by DHSS during calendar years 1999-2001.

Information on acute hazardous substances emergency events was collected. The types of data collected included general information on the event, substance(s) released, number of victims, number and types of adverse health effects experienced by the victims, and number of evacuations.

Several data sources were used to obtain the maximum amount of information about each event. These sources included, but were not limited to, the United States Coast Guard's National Response Center (NRC); Missouri Department of Natural Resources (DNR); Missouri State Highway Patrol (MSHP); facility personnel; and responding agencies. Prior to January 2000, the data obtained were computerized using an ATSDR-provided data entry system and were sent to ATSDR quarterly. Beginning in January 2000, data were entered into a Web-based data entry system that allows for real-time data entry.

DHSS reported a total of 957 events for calendar years 1999-2001; 510 (53.3%) of the events occurred at fixed facilities, and 447 (46.7%) were transportation related. Human error was the primary contributing factor for the majority of the releases (394, or 41.2%). In 842 (88%) of the events, only a single substance was released. The most commonly reported categories of substances released (excluding the categories of "other" and "other inorganic substances") were volatile organic compounds, acids and ammonia. During this reporting period, 205 events (approximately 21.4% of all reported events) resulted in a total of 425 victims. The adverse health effects most frequently experienced by victims were respiratory system irritation, headache and trauma. A total of 20 persons died as a result of all events, and 71 events required evacuations.

Since 1999, DHSS has actively recruited additional primary reporting sources, which has significantly increased the number of events reported when compared to previous years. Of specific interest is the number of individuals experiencing adverse health effects as a result of methamphetamine-related events, particularly law enforcement and fire personnel. Additional data gathered has prompted DHSS to develop prevention strategies targeted to this population group to increase awareness of the risks of injury when responding to methamphetamine-related events, and to provide recommendations on precautions to follow when entering an environment where known or suspected methamphetamine-related activities are or have been occurring.

HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE (HSEES)

INTRODUCTION

The surveillance system has four goals:

- To describe the distribution and characteristics of hazardous substances emergencies.
- To describe the morbidity and mortality experienced by employees, responders, and the general public as a result of hazardous substances releases.
- To identify risk factors associated with the morbidity and mortality.
- To identify strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

This report summarizes the characteristics of hazardous substances releases and the associated public health consequences of events reported by the Missouri HSEES program during calendar years 1999-2001.

METHODS

Releases are eligible for inclusion in the surveillance system if they are uncontrolled or illegal and require removal, cleanup, or neutralization according to federal, state, or local law. Threatened releases are also included in the system if: 1) they involve actions (such as evacuations) that are taken to protect the public health, and 2) they would have required removal, cleanup, or neutralization according to federal, state, or local law. A substance is considered hazardous if it can reasonably be expected to cause adverse human health outcomes from exposure.

In 1999, the Missouri HSEES program adopted ATSDR's recommendation to report all hazardous substance releases in which the quantity released was one-gallon/ten pounds or more. For substances with an Environmental Protection Agency (EPA) Reportable Quantity of one (1) pound or less, all releases are reported regardless of the quantity. All releases involving injuries and/or evacuations are also included. Releases to air and water that cannot be cleaned up are also included in the system if the amount released would need to be cleaned up if the spill had occurred on land. Events involving only petroleum products are excluded.

Various data sources were used to obtain notification about these events. These sources included, but were not limited to, the Missouri Department of Natural Resources' (DNR) Environmental Services Program, the United States Coast Guard's National Response Center (NRC), the United States Department of Transportation's Hazardous Materials Information System (HMIS), the Missouri State Highway Patrol (MSHP), the

National Fire Incident Reporting System (NFIRS) and the media. Additional information is obtained from responders, incident commanders, responsible parties, facility and transportation managers, hospitals, employees, witnesses and victims. Information collected for each event included:

- Date and time of occurrence
- Type of event (fixed-facility or transportation-related event)
- Causal factors
- Type of area in which the event occurred
- Substance(s) released
 - Substance name
 - Chemical form
 - Type of release (spill, air emission, fire, explosion)
 - Quantity released
- Victim(s)
 - Population group
 - Type of injury sustained
 - Severity
 - Demographics
 - Personnel protective equipment (PPE) worn
 - Distance from the release
- Evacuations
- Numbers of persons potentially affected (based on census data and working population)
- Public health activities initiated (environmental sampling, health advisory, health investigation)
- Response plans followed

Emergency events captured by HSEES are classified according to whether they occur at fixed facilities or during transportation. Fixed-facility events involve hazardous substances released at industrial sites, schools, farms, or other permanent facilities; transportation-related events involve hazardous materials released during transport by surface, air, or water. Victims are defined as individuals with symptoms (including psychological stress) or injuries (including death) that result from the event. Victims who receive more than one type of injury are counted once in each applicable type of injury.

Substances are grouped into 11 categories: acids, ammonia, bases, chlorine, mixtures, paints and dyes, pesticides, polychlorinated biphenyls, volatile organic compounds (VOCs), other inorganic substances, and other substances. The “mixtures” category consists of chemicals from different categories that are mixed before release, and the “other” category consists of chemicals that cannot be classified into any one of the other 10 chemical categories. The category “other inorganic substances” comprises all inorganic substances except acids, bases, ammonia, and chlorine.

Prior to January 2000, data were computerized using a data entry system provided by ATSDR, and sent to ATSDR quarterly. Beginning in January 2000, data were entered into a Web-based data entry system. ATSDR performs data management, data analysis, and report generation of the entered data. ATSDR provides DHSS with state-level data for analysis and report generation purposes. HSEES data are then used for prevention activities by ATSDR and by DHSS.

RESULTS

A total of 957 hazardous substances emergency events were reported during calendar years 1999-2001 to the HSEES system by DHSS. Of these, two events were threatened releases and four were actual and threatened releases, with the remainder being actual releases. Of all reported events, 53.3% (n=510) occurred at fixed facilities, and 46.7% (n=447) were transportation-related events (Table 1). Table 2 shows the number of events by county and type of event, while Figure 1 shows total events by county in a geographic format.

The most common areas involved in fixed-facility events in which only one area was involved (Figure 2) include indoor, non-industrial, living (residence) areas (19.7%, n=90), storage areas above ground (17.5%, n=80), and material handling areas (14.9%, n=68). 54 fixed-facility events (10.6%) involved more than one affected area. In transportation-related events, 414 (92.6%) occurred during ground transport (e.g., truck, van, or tractor), and 29 (6.5%) involved transport by rail (Figure 3). The remaining transportation-related events involved water, air or pipeline transport.

Primary and secondary factors contributing to events were also reported (Figure 4). Human error was the primary factor in 394 (41.2%) of the events. Equipment failure was the primary factor in 234 (24.5%) events, and illegal activity accounted for 151 (15.8%) events (primarily related to methamphetamine production). The remaining events (18.6%, n=178) were attributable to other primary factors.

Chemicals were considered either actually released or threatened to be released; 842 (88.0%) events involved the release of only one substance. Two substances were released in 50 (5.2%) events, and the remainder involved the release of more than two substances (Table 3). Of the total chemicals involved, 1,166 (99.0%) of the substances were actually released, and 12 (1.0%) of the substances were threatened to be released. The number of substances released was higher than the number of events, since more than one substance could be included in a release. Most substances released were either spills (57.8%, n=674) or air emissions (31.0%, n=361). Of the spills, 259 (38.4%) occurred in fixed-facility events and 415 (61.6%) occurred in transportation events. Of the air emissions, 316 (87.5%) occurred in fixed-facility events and 45 (12.5%) occurred in transportation events. The remaining releases resulted from fires (2.8%, n=33) and explosions (0.9%, n=11), or combinations of two types of releases (7.5%, n=87).

Of the 811 events with a known time of occurrence, 310 (38.3%) occurred from 6:00 a.m. to 12:00 noon, and 230 (28.4%) occurred from 12:01 p.m. to 6:00 p.m. Of the

957 events reported, 148 (15.5%) occurred on a Saturday or Sunday. Agricultural events resulting from spills during the planting season account for the increased number of events reported in the months of April through August. During calendar years 1999-2001, 476 events (49.7%) occurred during this time of year (although not all events were related to agricultural activities).

SUBSTANCE CATEGORIES

Of the 11 categories into which HSEES substances were grouped, the categories of substances most commonly released in fixed-facility events were volatile organic compounds (21.3%, n=147) and ammonia (19.4%, n=134) (Table 4). In transportation-related events, chemicals categorized as “other” (28.8%, n=136) and volatile organic compounds (18.0%, n=85) were most frequently released. The 10 substances most frequently released in Missouri for calendar years 1999-2001 are listed in Appendix A.

VICTIMS

A total of 425 victims were involved in 205 events (21.4% of all events) (Table 5). Of the events with victims, 66.8% (n=137) involved only one victim, and 15.1% (n=31) involved two victims. Fourteen events (6.8%) involved five or more victims. Of the total number of victims, 288 (67.8%) were injured during fixed-facility events. For transportation events, 73 victims (17.2%) sustained injuries as a result of a motor vehicle accident or rollover; however, the injuries were not associated with the substance(s) released.

The substances most frequently released may not necessarily be the most likely to result in victims (Table 6). For example, polychlorinated biphenyls were released during 24 events; however, only one of these events (4.2%) resulted in adverse health effects. Conversely, chlorine was released in only 14 events, and six of these events (42.9%) resulted in adverse health effects, indicating its greater potential for immediate harm. The high percentage of releases with victims for acids and ammonia is due primarily to injuries associated with methamphetamine production and ammonia theft.

The population groups most often adversely affected were first responders (45.4%, n=193) and employees (32.5%, n=138) (Figure 5). There were 155 first responder victims in fixed-facility events. Of those, 135 (87.1%) were police officers (Figure 6). There were 38 first responder victims in transportation-related events. Of these, 36 were police officers (94.7%). Many of these officers were injured during methamphetamine-related events.

The types of adverse health effects sustained by victims are shown in Table 7 and Figure 7. The 425 victims sustained a total of 587 adverse health effects, as some victims had more than one adverse health effect. The most commonly reported adverse health effects in fixed-facility events were respiratory system problems (38.4%, n=160), headache (22.1%, n=92) and eye irritation (18.9%, n=79). The most commonly reported adverse health effects in transportation-related events were trauma (42.9%, n=73),

respiratory system problems (18.2%, n=31) and headache (15.9%, n=27). Trauma was reported more frequently in transportation-related events (42.9%) than in fixed-facility events (5.8%). All trauma injuries in transportation events were caused by a motor vehicle accident or rollover leading to the release of a hazardous substance, not by exposure to the hazardous substance itself.

Injuries reported by an official within 24 hours of the event (39.8%, n=169) were the most frequent injury outcome (Figure 8). The majority of these injuries were self-reported by law enforcement officers responding to and/or collecting evidence from clandestine methamphetamine laboratories. A total of 117 victims (27.5%) were treated at a hospital but were not admitted; 66 (15.5%) were treated on-scene; and 42 (9.9%) were treated at a hospital and admitted.

Of the 20 deaths reported, ten resulted from one event involving a 32-vehicle accident caused by bad weather conditions. One of the vehicles involved in the accident was carrying hydrochloric acid, which was released during the collision and ensuing fire. Of the remaining ten deaths, three resulted from explosions at fireworks manufacturing facilities (three events); three were the result of injuries sustained during motor vehicle accidents (three events); two resulted during the transport of anhydrous ammonia in conjunction with mobile methamphetamine labs (two events); and one individual died after dropping a large tank of liquid oxygen to the concrete during transfer, causing the tank and three adjacent tanks to explode.

The sex of 235 (55.3%) of the victims was known; of these, 195 (83.0%) were male. Among males, the majority were employees (41.0%, n=80) and first responders (33.3%, n=65). Among the 40 females, the majority were members of the general public (57.5%, n=23) and employees (37.5%, n=15). The age of 122 (28.7%) of the victims was known; of these, the mean age was 38 years (range: 8-74 years, median = 37.5).

Among the victims, 87.7% of employees (n=121) had not worn any form of personal protective equipment (PPE), compared to only 13.0% (n=25) of the first responders. It was not known if PPE was worn for two employees and 14 responders. Of the first responder victims, the most frequently worn PPE were gloves (59.3%, n=118), Level C PPE (11.6%, n=23), fire fighter turn-out gear (10.1%, n=20) and eye protection (10.1%, n=20). Of employee victims reported as wearing PPE, the most frequently worn PPE were steel-toed shoes (44.4%, n=12) and eye protection (40.7%, n=11).

Level "A" protection is worn when the highest level of respiratory, skin, and eye protection is needed. It includes a supplied-air respirator, approved by the Mine Safety and Health Administration (MSHA), U.S. Department of Labor, and the National Institute for Occupational Safety and Health (NIOSH); pressure-demand, self-contained breathing apparatus; fully encapsulating chemical-resistant suit; coveralls; long cotton underwear; chemical resistant gloves (inner); boots, chemical-resistant, steel toe and shank; hard hat; disposable gloves and boot covers; cooling unit; and 2-way radio communications. Level "D" protection is worn as a work uniform and is not recommended for sites with respiratory or skin hazards. Level "D" protection includes

coveralls, gloves, boots/shoes (leather or chemical-resistant, steel toe and shank), safety glasses or chemical splash goggles, and hard hat. Level "D" protection provides no protection against chemical hazards. Firefighter turnout gear is protective clothing normally worn by firefighters during structural fire-fighting operations, and is similar to level "D" protection.

EVACUATIONS

Evacuations were ordered in 71 events (7.4%). A total of 46 (64.8%) evacuations involved the building or the affected part of a building, 23 (32.4%) involved an area besides the building, and two (2.8%) were reported as having no evacuation criteria. The number of persons evacuated was known for 65 of the 71 events. The median number of persons evacuated was 24 (range: 1-2,500). The length of evacuation was known for 67 of the 71 events. The median length of evacuation was four hours (range: 1-168).

In three events, an official ordered in-place sheltering and provided instructions regarding precautions to take. Individuals self-evacuated in six events, but an official evacuation was not ordered. The number of people who self-evacuated was not known for any of these events.

CONTINGENCY PLANS

Contingency plans were followed by the incident commander in 943 (98.5%) of the events. Of the 941 events with known contingency plans followed, the most frequent types of contingency or preparedness plans used during events were the company's standard operating procedures (56.2%, n=530) and the HAZMAT/response team's standard operating procedures (37.5%, n=354). The type of plan followed was not known for only two (0.2%) events.

METHAMPHETAMINE EVENTS

During calendar year 2001, local, state and federal officials reported 2,130 seizures of methamphetamine labs, dumpsites and locations of inactive labs in Missouri – more than any other state in the nation. The prevalence of methamphetamine labs in the state, and the potential for injuries to responders and the general public, demands that additional data be gathered regarding the public health impact of methamphetamine-related activities. Events relating to methamphetamine production are included in the HSEES system if one or more of the following criteria are met:

- The quantity of the substance(s) released exceeds one gallon/ten pounds
- One or more individuals is evacuated from the area due to actual or potential exposure to the substances used to produce methamphetamine
- One or more individuals suffer an adverse health effect from exposure to the substances used to produce methamphetamine

The Missouri HSEES program has established additional reporting sources to obtain data on methamphetamine-related events not typically reported to any other primary notification source. During calendar year 2000, the program began receiving Chemical Exposure Reports from the Missouri Highway Patrol for officers exposed to hazardous substances during methamphetamine-related events. Additionally, the program began utilizing data from the National Fire Incident Reporting System (NFIRS) in 2002, which has provided a significant amount of data on methamphetamine-related emergency events.

During calendar years 1999-2001, 146 of the 957 events reported (15.3%) were a result of methamphetamine-related activity. A total of 98 (67.1%) of the events were related to the collection or processing of evidence from fixed methamphetamine labs; 29 (19.9%) were mobile methamphetamine labs or events involving the transport of substances to be used for methamphetamine production; and 19 (13.0%) were related to the theft of anhydrous ammonia, a common ingredient used in the process of “cooking” methamphetamine.

A total of 314 substances were released during these 146 events. The most frequently released substances include ammonia (26.1%, n=81), ethyl ether (21.3%, n=67) and acids (18.5%, n=58). The quantity released was known for only 17 (11.6%) of the 146 events. All of these 17 events involved ammonia. The amount of ammonia released ranged from 20 pounds to 13 tons.

A total of 193 individuals (45.4% of the total victims for all HSEES events) suffered one or more adverse health effect during 129 (88.4%) of the 146 events related to methamphetamine production. Of the victims, 178 (92.2%) were responders and 15 (7.8%) were members of the general public. Of the 178 responders, 168 were police officers. The majority of injuries (81.9%, n=158) were reported by an official within 24 hours and the severity and treatment of the injuries is not known; however, 20 (10.4%) of the victims were treated at a hospital but were not admitted; 8 (4.1%) were treated at the scene; and 4 (2.1%) were transported to a hospital and admitted. Two members of the general public died during two separate methamphetamine-related events. Of the 269 injuries recorded for methamphetamine-related events, the most common injuries reported were headache (42.0%, n=113) and respiratory system irritation (41.3%, n=111).

Evacuations were ordered in 11 (7.5%) of the 146 events resulting from methamphetamine-related activity. The number of people evacuated was known in nine of the 11 events and ranged from seven to 300. The total number of people evacuated in these nine events was 535. Six of the events involving an evacuation were caused by the theft of anhydrous ammonia, while five were due to methamphetamine labs.

As part of the Missouri HSEES program’s 2002 prevention outreach plan, an in-depth analysis is being conducted of all methamphetamine events reported during 2000 and 2001, with specific analysis of those events involving police officers. When finalized, this report will be shared with the Missouri State Highway Patrol and other law enforcement agencies, along with recommendations for training for officers involved in

the execution of search warrants or collection of evidence for suspected methamphetamine labs. This report will also be made available on the Missouri HSEES web site at www.dhss.state.mo.us/hsees when it is finalized and approved for release.

USES OF HSEES DATA

During 1999-2001, the Missouri HSEES program continued to respond to requests for HSEES information and data from local, state and federal agencies and organizations. The program received several requests for information from the media, which was used to supplement articles on the prevalence and hazards of methamphetamine labs and anhydrous ammonia theft. Missouri HSEES data were also presented at a number of state and national conferences, including:

- HAZMAT 2000 International Conference (April 2000)
- National Environmental Health Association Annual Conference (June 2000)
- Central States Agricultural Health and Safety Conference (September 2000)
- Missouri Geographic Information Systems (GIS) Conference (March 2001)
- State Emergency Management Agency Annual Conference (April 2001)

Data were also used to develop fact sheets on some of the most frequently released substances (ammonia, sulfuric acid, polychlorinated biphenyls, ethylene glycol, hydrochloric acid, chlorine, mercury and lead). These fact sheets were distributed to more than 1,100 facilities that use, store, manufacture and/or transport one or more of these substances, and were distributed at conference presentations and training sessions.

In September 2000, Missouri finalized the state HSEES web site, which contains all reports and fact sheets developed by the program since 1999. Postcards were sent to more than 5,000 facilities and federal, state and local agencies announcing the web site availability. In the first two years the web site has been available, more than 58,000 hits have been received.

SUMMARY OF RESULTS, 1994-2001

The number of events by type, substances released, events with victims and deaths for the years 1994 through 2001 are shown in Table 8. The number of events, substances released and events with victims has increased during calendar years 2000-2001 due to increased event notification relating to methamphetamine activities. Although employees were the most commonly reported victims of emergency events during the 1994-1998 data analysis period, responders are now the most commonly reported, specifically police officers. Prevention activities geared towards increased awareness among first responders involved in methamphetamine-related events have been developed and are being implemented to decrease the morbidity and mortality caused by these events.

Findings from HSEES data collection efforts provide useful information about risk factors related to emergency events and the associated public health impact. This information is used to develop prevention outreach activities, and is instrumental in developing state and local emergency response plans for accidental and intentional releases.

APPENDICES

Appendix A—The 10 most frequently released substances, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

Number	Standardized Substance Name	Frequency
1.	Ammonia	147
2.	Ethyl Ether	68
3.	Paint or Coating NOS	54
4.	Hydrochloric Acid	48
5.	Mercury	40
6.	Sulfuric Acid	36
7.	Resin Solution	32
8.	Acid NOS	27
9.	Sodium Hydroxide	25
10.	Polychlorinated Biphenyls	24
Total		501

Table 1.—Number of events meeting the surveillance definition, by year and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

Year	Type of event				Total no. of events
	Fixed-facility		Transportation		
	No. of events	%	No. of events	%	
1999	166	57.0	125	43.0	291
2000	199	55.1	162	44.9	361
2001	145	47.5	160	52.5	305
Total	510	53.3	447	46.7	957

Table 2. —Number of events meeting the surveillance definition, by county and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

County	Type of event				Total no. of events
	Fixed-facility		Transportation		
	No. of events	%	No. of events	%	
Adair	0	0.0	1	<1.0	1
Andrew	0	0.0	1	<1.0	1
Atchison	1	<1.0	3	<1.0	4
Audrain	6	1.2	3	<1.0	9
Barry	6	1.2	1	<1.0	7
Barton	1	<1.0	1	<1.0	2
Bates	2	<1.0	2	<1.0	4
Benton	2	<1.0	0	0.0	2
Boone	8	1.6	8	1.8	16
Buchanan	6	1.2	7	1.6	13
Butler	5	<1.0	1	<1.0	6
Callaway	10	2.0	5	1.1	15
Camden	3	<1.0	1	<1.0	4
Cape Girardeau	3	<1.0	4	<1.0	7
Cass	5	<1.0	2	<1.0	7
Cedar	1	<1.0	0	0.0	1
Christian	4	<1.0	3	<1.0	7
Clark	0	0.0	1	<1.0	1
Clay	13	2.5	7	1.6	20
Clinton	1	<1.0	1	<1.0	2
Cole	12	2.4	2	<1.0	14
Cooper	2	<1.0	4	<1.0	6
Crawford	8	1.6	2	<1.0	10
Dade	2	<1.0	0	0.0	2
Dallas	1	<1.0	1	<1.0	2
Dent	0	0.0	1	<1.0	1
Dunklin	1	<1.0	0	0.0	1
Franklin	18	3.5	2	<1.0	20
Gentry	0	0.0	2	<1.0	2
Greene	26	5.1	68	15.2	94
Grundy	1	<1.0	1	<1.0	2
Henry	2	<1.0	2	<1.0	4
Hickory	1	<1.0	1	<1.0	2
Holt	1	<1.0	0	0.0	1
Howard	2	<1.0	1	<1.0	3
Howell	1	<1.0	0	0.0	1

Table 2. —Number of events meeting the surveillance definition, by county and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.
(continued)

County	Type of event				Total no. of events
	Fixed-facility		Transportation		
	No. of events	%	No. of events	%	
Iron	0	0.0	3	<1.0	3
Jackson	41	8.0	55	12.3	96
Jasper	23	4.5	20	4.5	43
Jefferson	31	6.1	7	1.6	38
Johnson	6	1.2	0	0.0	6
Laclede	2	<1.0	2	<1.0	4
Lafayette	2	<1.0	6	1.3	8
Lawrence	6	1.2	4	<1.0	10
Lewis	0	0.0	1	<1.0	1
Lincoln	6	1.2	0	0.0	6
Livingston	1	<1.0	0	0.0	1
Macon	2	<1.0	1	<1.0	3
Madison	2	<1.0	1	<1.0	3
Maries	0	0.0	1	<1.0	1
Marion	8	1.6	8	1.8	16
McDonald	3	<1.0	0	0.0	3
Mercer	0	0.0	1	<1.0	1
Miller	3	<1.0	0	0.0	3
Mississippi	0	0.0	1	<1.0	1
Moniteau	1	<1.0	0	0.0	1
Monroe	2	<1.0	0	0.0	2
Montgomery	2	<1.0	4	<1.0	6
New Madrid	0	0.0	5	1.1	5
Newton	1	<1.0	2	<1.0	3
Oregon	1	<1.0	1	<1.0	2
Osage	1	<1.0	1	<1.0	2
Ozark	0	0.0	1	<1.0	1
Pemiscot	0	0.0	3	<1.0	3
Pettis	7	1.4	1	<1.0	8
Phelps	4	<1.0	5	1.1	9
Pike	9	1.8	1	<1.0	10
Platte	4	<1.0	2	<1.0	6
Polk	4	<1.0	3	<1.0	7
Pulaski	5	<1.0	0	0.0	5
Putnam	0	0.0	1	<1.0	1
Ralls	0	0.0	2	<1.0	2

Table 2.—Number of events meeting the surveillance definition, by county and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.
(continued)

County	Type of event				Total no. of events
	Fixed-facility		Transportation		
	No. of events	%	No. of events	%	
Randolph	2	<1.0	0	0.0	2
Ray	0	0.0	2	<1.0	2
Reynolds	0	0.0	4	<1.0	4
Saline	2	<1.0	0	0.0	2
Scotland	0	0.0	1	<1.0	1
Scott	3	<1.0	2	<1.0	5
St. Charles	11	2.2	20	4.5	31
St. Clair	2	<1.0	0	0.0	2
St. Francois	10	2.0	3	<1.0	13
St. Louis	41	8.0	28	6.3	69
St. Louis City	73	14.3	92	20.6	165
Ste. Genevieve	4	<1.0	1	<1.0	5
Stoddard	1	<1.0	2	<1.0	3
Stone	5	<1.0	2	<1.0	7
Sullivan	2	<1.0	0	0.0	2
Taney	3	<1.0	3	<1.0	6
Texas	2	<1.0	1	<1.0	3
Vernon	4	<1.0	0	0.0	4
Warren	3	<1.0	0	0.0	3
Washington	5	<1.0	2	<1.0	7
Wayne	2	<1.0	0	0.0	2
Webster	3	<1.0	1	<1.0	4
Wright	0	0.0	1	<1.0	1
TOTAL:	510	53.3	447	46.7	957

Figure 1.—Geographic distribution of events by county, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

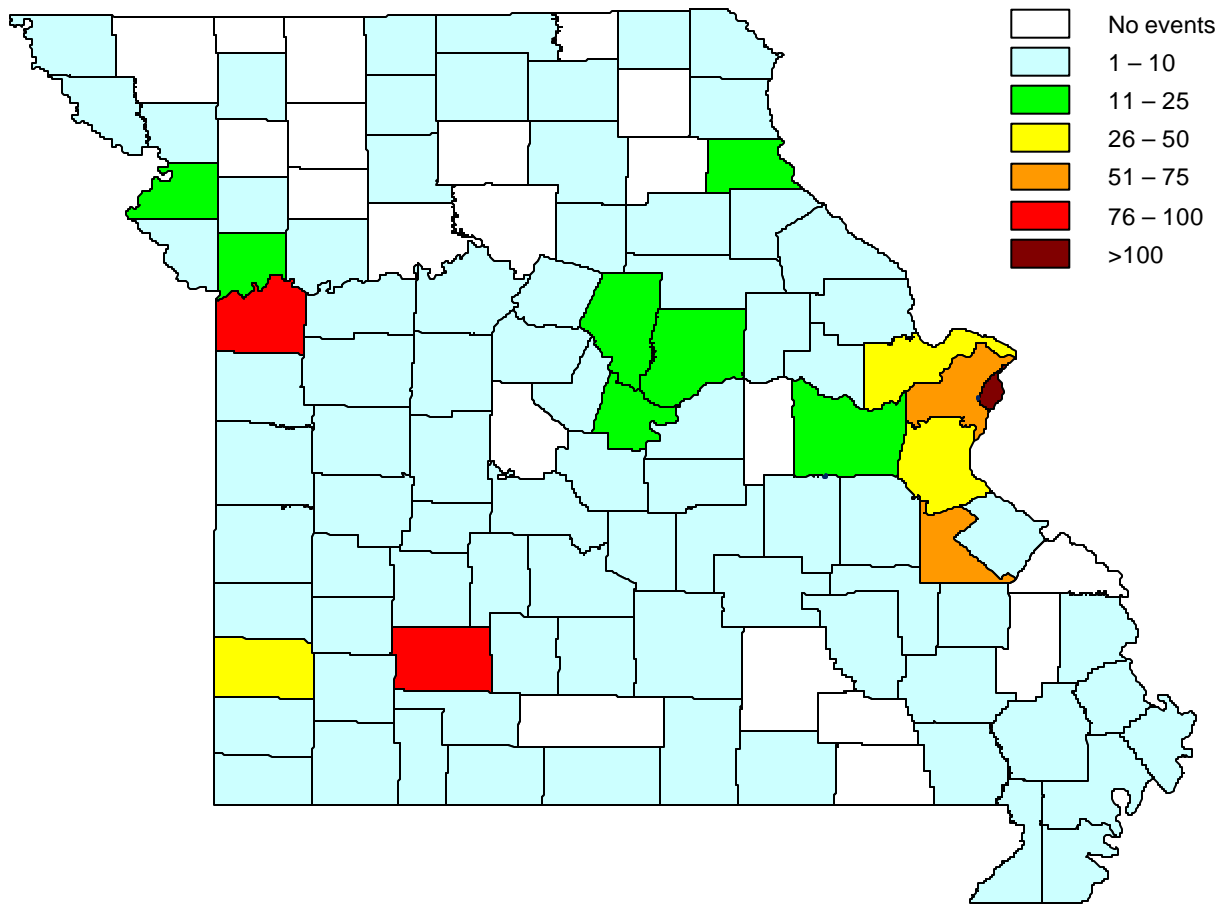


Figure 2. —Areas of fixed facilities involved in events, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

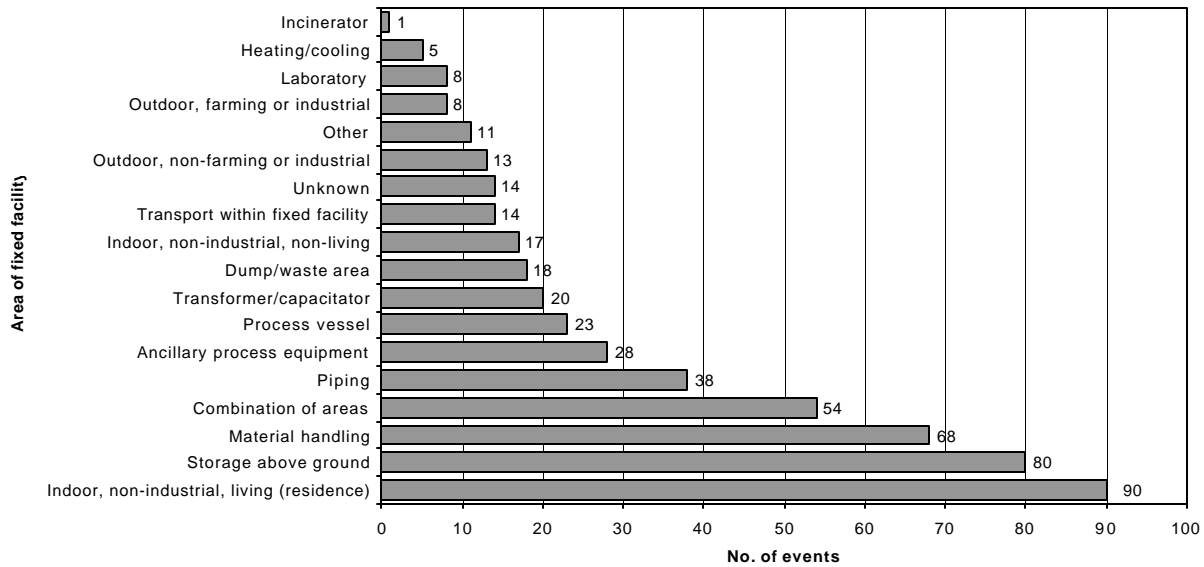


Figure 3. —Distribution of transportation-related events, by type of transport, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

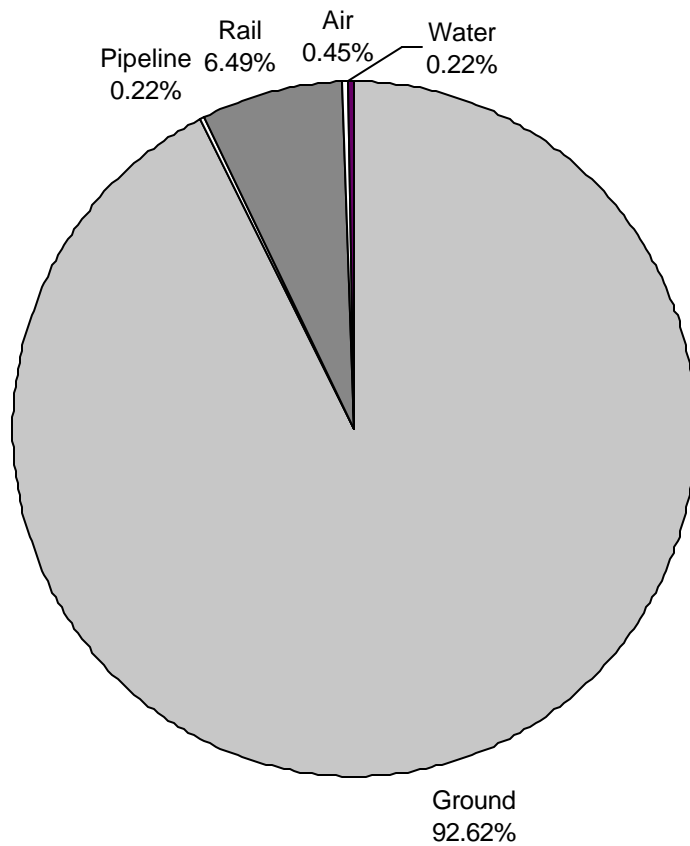


Figure 4. —Primary factors reported as contributing to the occurrence of events, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

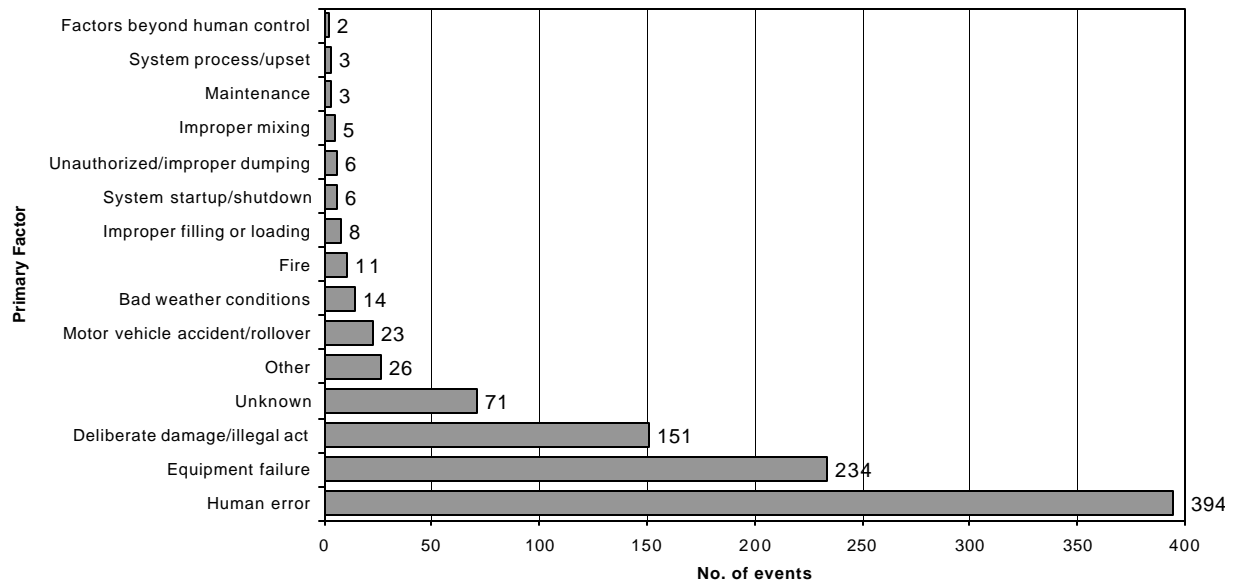


Table 3.—Distribution of the number of substances released, by type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001. *

No. of substances released	Type of event						All events		
	Fixed-facility			Transportation					
	No. events	%	No. of substances	No. events	%	No. of substances	No. events	%	No. of substances
1	415	81.5	415	427	95.7	427	842	88.2	842
2	38	7.5	76	12	2.7	24	50	5.2	100
3	28	5.5	84	4	0.9	12	32	3.4	96
4	26	5.1	104	3	0.7	12	29	3.0	116
= 5	2	0.4	12	0	0.0	0	2	0.2	12
Total	509	100.0	691	446	100.0	475	955	100.0	1,166

* Does not include substances that were threatened to be released

Table 4.—Distribution of the number of substances released, by substance category and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

Substance category	Type of event				All events	
	Fixed-facility		Transportation			
	No. of substances	(%)	No. of substances	(%)	No. of substances	(%)
Acids	88	12.7	72	15.2	160	13.7
Ammonia	134	19.4	14	2.9	148	12.7
Bases	22	3.2	34	7.2	56	4.8
Chlorine	12	1.7	2	0.4	14	1.2
Mixtures *	12	1.7	8	1.7	20	1.7
Other inorganic substances	105	15.2	45	9.5	150	12.9
Other substances	110	15.9	136	28.6	246	21.1
Paints and dyes	25	3.6	46	9.7	71	6.1
Pesticides	12	1.7	30	6.3	42	3.6
Polychlorinated biphenyls	23	3.3	1	0.2	24	2.1
Volatile organic compounds	148	21.4	87	18.3	235	20.2
Total **	691	99.8	475	100.0	1,166	100.1

* Mixtures of substances from different categories

** Percentages may not total 100% due to rounding

Table 5.—Distribution of the number of victims, by type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

No. of victims	Type of event					All events			
	Fixed-facility		Transportation						
	No. of events	(%)	No. of victims	No. of events	(%)	No. of victims	No. of events	(%)	No. of victims
1	95	66.4	95	42	67.7	42	137	66.8	137
2	22	15.4	44	9	14.5	18	31	15.1	62
3	14	9.8	42	4	6.5	12	18	8.8	54
4	3	2.1	12	2	3.2	8	5	2.4	20
5	5	3.5	25	3	4.8	15	8	3.9	40
=6	4	2.8	70	2	3.2	42	6	2.9	112
Total *	143	100.0	288	62	99.9	137	205	99.9	425

* Percentage may not total 100% due to rounding

Figure 5. —Distribution of victims by population group* and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

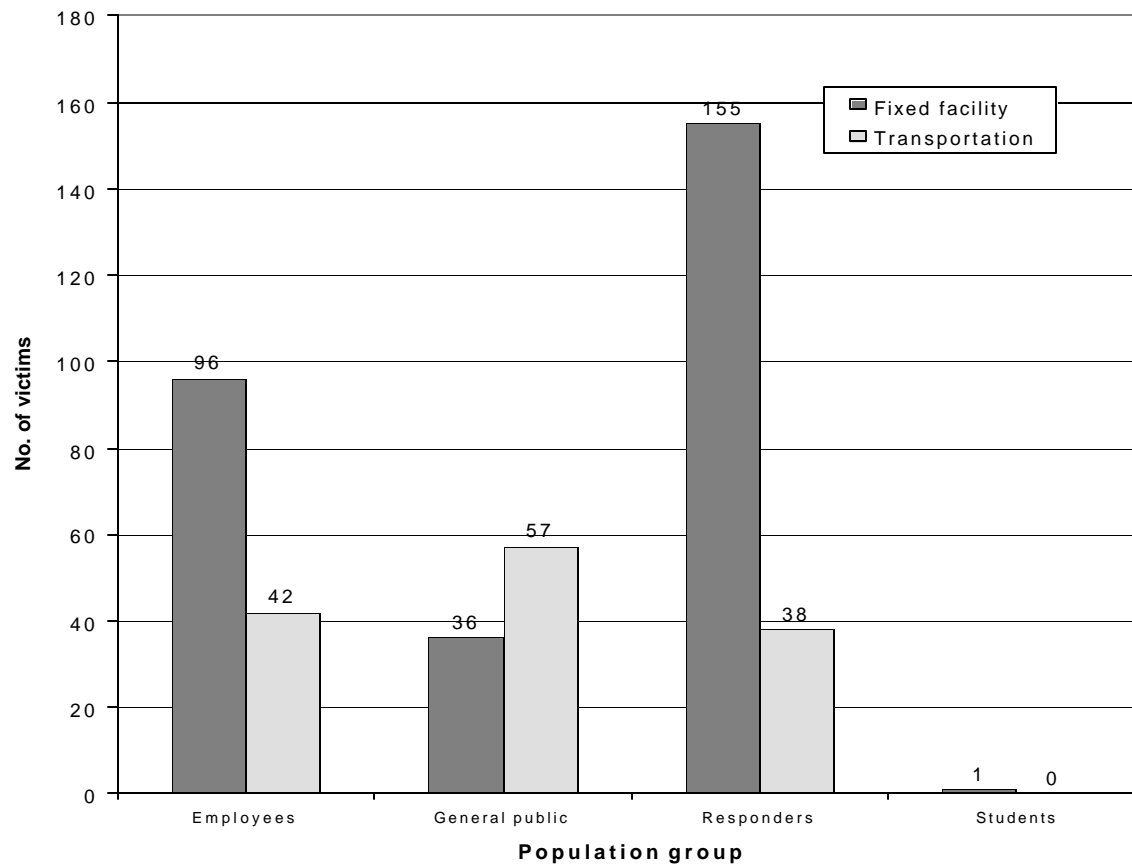
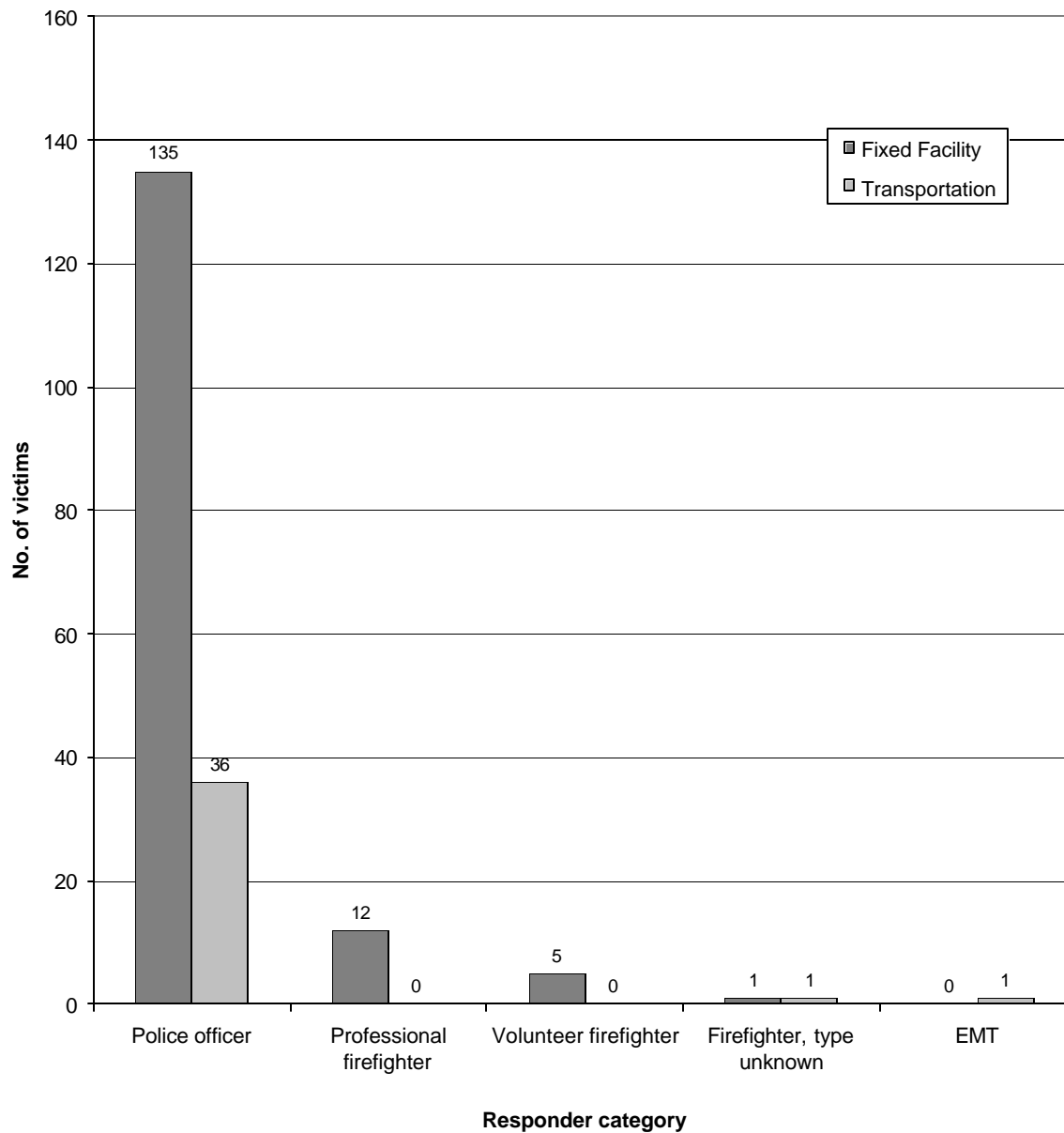


Table 6.—Number of substances released in all events and events with victims, by substance category, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

Substance category	Total releases		Releases with victims		
	No.	Percentage of total releases	No.	Percentage of all releases with victims	Percentage of releases in substance category
Acids	160	13.7	68	16.9	42.5
Ammonia	148	12.7	68	16.9	45.9
Bases	56	4.8	7	1.7	12.5
Chlorine	14	1.2	6	1.5	42.9
Mixtures	20	1.7	6	1.5	30.0
Other inorganic substances	150	12.9	41	10.2	27.3
Other, not otherwise specified	246	21.1	60	14.9	24.4
Paints and dyes	71	6.1	6	1.5	8.5
Pesticides	42	3.6	8	2.0	19.0
Polychlorinated biphenyls	24	2.1	1	0.2	4.2
Volatile organic compounds	235	20.2	131	32.6	55.6
Total *	1,166	100.1	402	99.9	34.5

*Total exceeds total number of events because events at which more than one substance was released were counted more than once.

Figure 6. —Distribution of responder victims,* by population group and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.



* There were 193 responder victims reported to the Missouri HSEES program during calendar years 1999-2001.

Figure 7. —Distribution of type of injury for all events, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

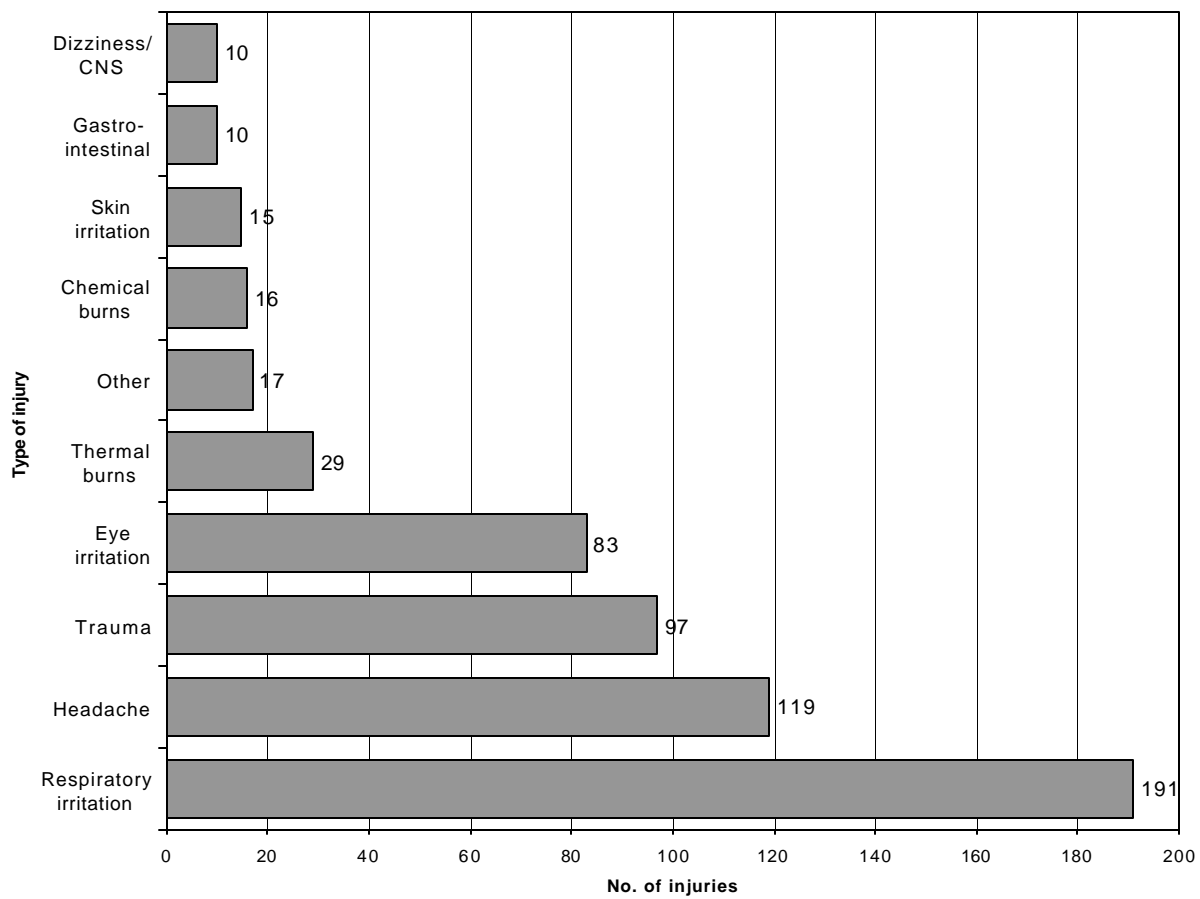


Table 7.—Distribution of type of adverse health effect, by type of event,* Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

Type of adverse health effect	Type of events				All events	
	Fixed-facility		Transportation			
	No.	%	No.	%	No.	%
Chemical burns	9	2.1	7	4.1	16	2.7
Dizziness/CNS [†]	8	1.9	2	1.2	10	1.7
Eye irritation	79	18.9	4	2.4	83	14.1
Gastrointestinal problems	5	1.2	5	2.9	10	1.7
Headache	92	22.1	27	15.9	119	20.3
Respiratory problems	160	38.4	31	18.2	191	32.5
Skin irritation	12	2.9	3	1.8	15	2.6
Thermal burns	19	4.6	10	5.9	29	4.9
Trauma	24	5.8	73	42.9	97	16.5
Other	9	2.1	8	4.7	17	2.9
Total	417	100.0	170	100.0	587	99.9

* The number of injuries is greater than the number of victims, because a victim could have had more than one injury.

[†] Central nervous system symptoms.

Figure 8. —Injury outcome, Hazardous Substances Emergency Events Surveillance, Missouri, 1999-2001.

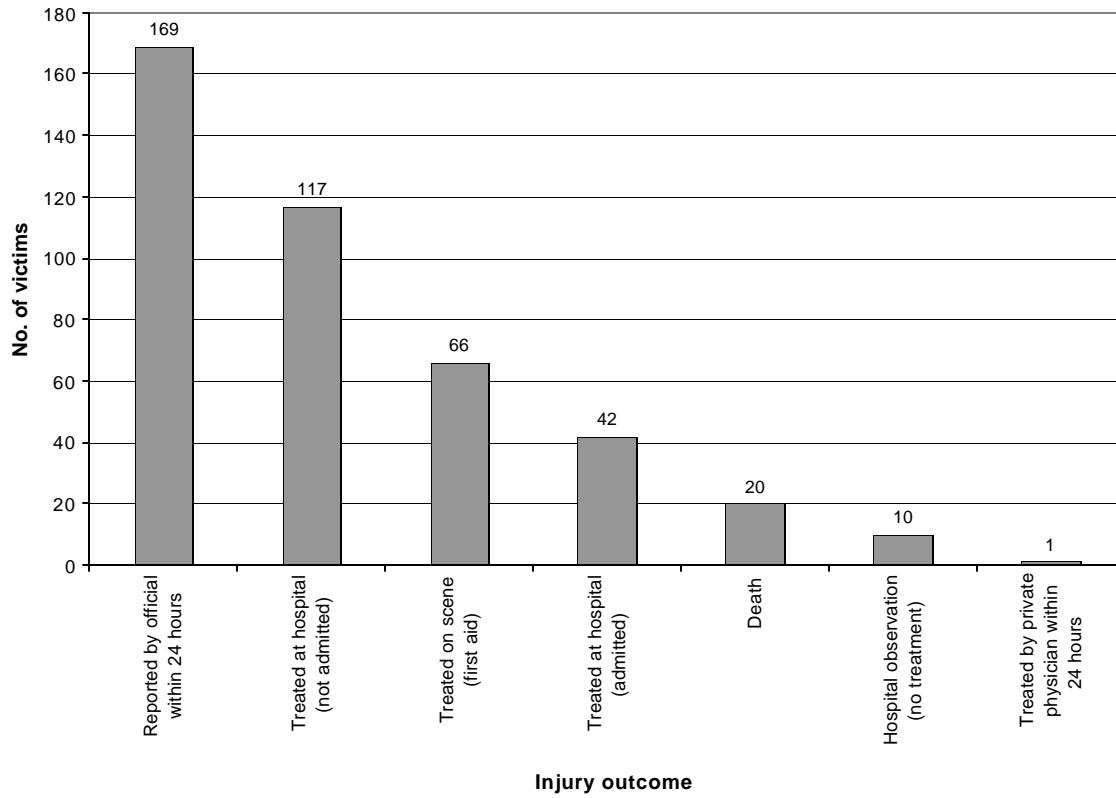


Table 8.—Cumulative data, Hazardous Substances Emergency Events Surveillance, Missouri, 1994-2001.

Year	Type of event			No. of substances released	No. of deaths	No. of victims	Events with victims	
	Fixed-facility	Transport	Total				No.	%
1994	137	67	204	231	1	32	15	7.4
1995	172	156	328	360	1	13	9	2.9
1996	109	51	160	175	2	59	12	6.9
1997	113	70	183	216	1	23	13	7.1
1998	145	51	196	197	2	24	17	8.7
1999	166	125	291	312	3	71	23	7.4
2000	199	162	361	486	14	197	103	28.5
2001	145	160	305	369	3	157	79	25.9
Total	1,186	842	2,028	2,346	27	576	271	13.4

Figure 9.—Distribution of victims, Hazardous Substances Emergency Events Surveillance, Missouri, 1994-2001.

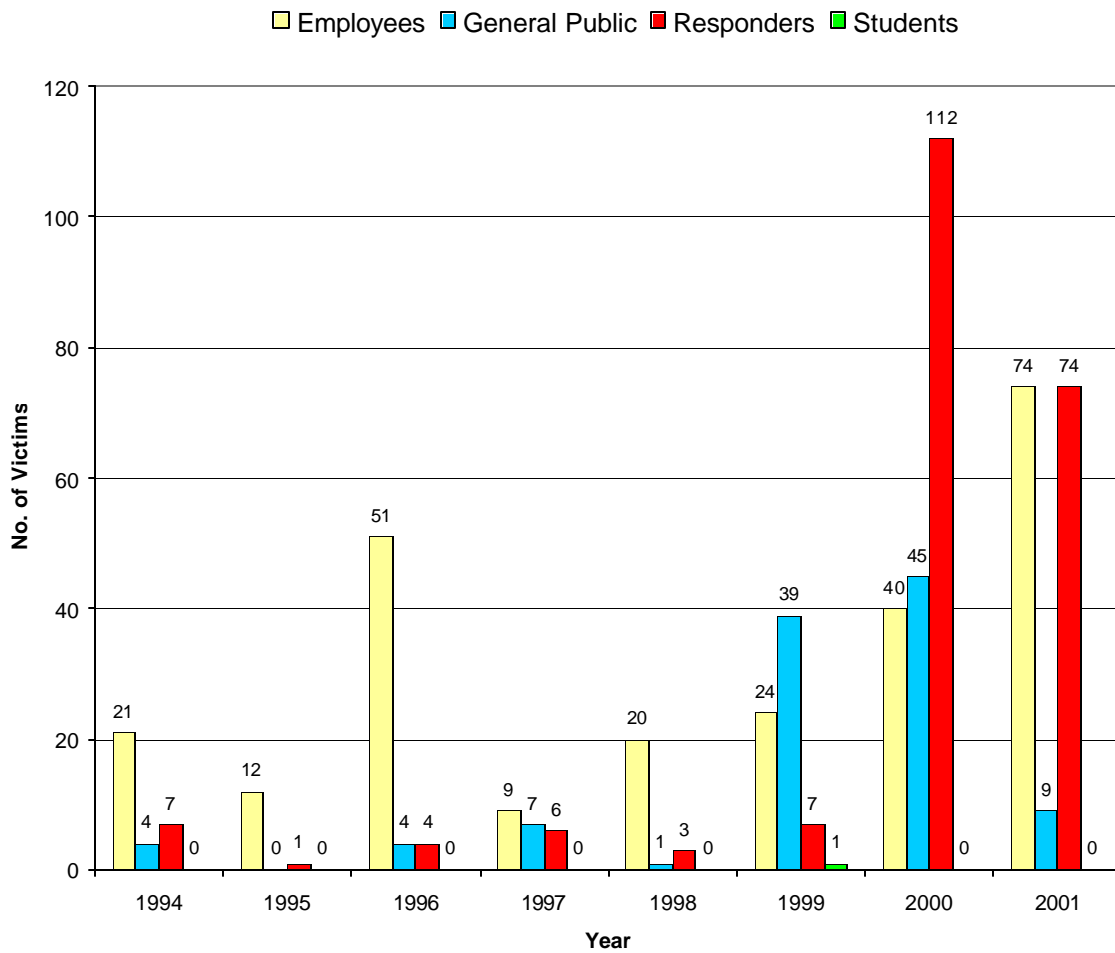


Figure 10. —Cumulative data for Missouri, Hazardous Substances Emergency Events Surveillance, 1994-2001.

